ENDANGERED Species BULLETIN

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When picturing wildlife habitat, most people envision a park or wildlife refuge, not a military base. But Department of Defense installations contain some of the best remaining habitats for our nation's vulnerable plant and animal species. Extensive areas of exceptional ecological value have been spared from development by the closures necessary for military testing and training. In 1991, Congress directed the Pentagon to "address urgent issues of biological diversity" as part of the Defense Department's Legacy Resource Management Program. To help accomplish this task, Defense has reached out to form partnerships with the Fish and Wildlife Service, and a variety of other agencies and organizations. This edition of the ***Endangered Species Bulletin*** *features some of these cooperative conservation efforts.*

photo by Peter Rowlands

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On the Cover
Natural resources conservation staff at Barry M. Goldwater Air Force Range in Arizona conduct an inventory of possible threatened and endangered species on the facility.
photo by A1C Robert G. Keller, USAF

The Endangered Species Bulletin welcomes manuscripts on a wide range of topics related to endangered species. We are particularly interested in news about recovery, habitat conservation plans, and cooperative ventures. Please contact the Editor before preparing a manuscript. We cannot guarantee publication.

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IN THIS ISSUE

by L. Peter Boice

Defending Our Nation *and* its Biodiversity

*M*any DoD lands have been protected from development pressures and other potentially damaging uses for years. Access has been limited because of security considerations and the need for safety buffer zones. DoD lands are found in many different parts of the country, and contain some of the finest remaining examples of such rare native vegetative communities as old-growth forest, tall-grass prairies, and vernal pool wetlands. Approximately 220 federally listed species, and additional "candidate" species, are known to inhabit lands under DoD control.

The Department of Defense (DoD) manages 25 million acres (10.1 million hectares) on more than 425 major military installations, making it the nation's fifth largest Federal land management department. These lands are used for a wide variety of purposes, including munitions testing, deployment of weapons systems, and combat training. Other areas, such as marine and estuarine environments, are sites for training exercises, vessel tests, and deployment of submarine tracking equipment. Designated airspace is used to train pilots and test fighter planes and air-based weapons systems. DoD is also the steward for some of the nation's most important plant and animal resources.

DoD has embraced its stewardship responsibilities for these valuable resources. But management decisions affecting DoD installations must be based on the fact that these lands were set aside to serve military training and testing purposes. The challenge for DoD is to balance the need for use of its air, land, and water resources in military training with the need to conserve these resources for future generations.

Given the complexity of this management challenge, DoD has experienced occasional conflicts between its military mission and its legal mandate to protect threatened and endangered species. During the past decade, about 15 installations have needed to modify or restrict military training or testing to comply with the Endangered Species Act. Among such changes have been modifications of training schedules, the temporary closing of specific areas, restrictions on the types of activities permitted, and improved awareness training for troops using sensitive areas. Although these modifications have not been without cost, long-term military readiness has not been affected. By cooperatively addressing these difficult issues, DoD has forged good working relationships with the Fish and Wildlife Service and the National Marine Fisheries Service. This has resulted in management solutions that generally meet both military and species needs.

Several factors suggest that threatened and endangered species management will remain challenging for DoD. First, as time goes on, an increasing number of species will be listed and need protection. Also, as some military installations close and weapons systems become more sophisticated, demands will increase on DoD's remaining training lands. A further complication is that the areas around many military installations have experienced rapid development over the past 50 years. Increasingly, DoD lands are becoming "islands" of protection within "seas" of development. For these reasons, DoD is

Opposite Page:
DoD protects the threatened desert tortoise* (Gopherus agassizii) *and other vulnerable animals and plants of the Mojave, and is interested in the region's long-term sustainability.
photo © Beverly Steveson

looking to regional partnerships as a means of sharing responsibility for species management and recovery, thereby reducing the potential for future restrictions on military operations.

Supporting the Military Mission

The Army's Integrated Training Area Management (ITAM) program is a premier example of how the conservation program directly supports the training mission by protecting and maintaining soils, vegetation, and other resources. By integrating military training and testing with the land's ability to support mission requirements, ITAM has saved money and increased mission capacity at more than 60 Army training sites. The program avoids unnecessary and irreparable damage to vital training ranges, and provides accurate assessments of land conditions to managers and commanders. Other benefits of ITAM include increased training realism, reduced costs for environmental compliance and restoration, and a continued high level of both military readiness and land stewardship.

Another important conservation program that supports the military mission focuses on bird behavior studies. DoD has established monitoring stations across the country to determine population trends, and additional data come from DoD's network of state-of-the-art weather surveillance radar sites. "Next-generation" radar detects birds during migration and provides information about their numbers, general direction of flight, and altitude. Other studies have used satellite telemetry and micro-transmitters for long-range tracking of raptors. Knowing where birds travel, nest, and feed helps DoD avoid potential bird-aircraft collisions while enhancing resource management decisions.

Enhanced Resource Management

DoD has adopted a systematic approach to identify, evaluate, and manage the resources found on military installations. Baseline surveys distinguish areas that can support testing and training from those that should be avoided or protected. More detailed analysis assesses how resources will be affected by mission activities and other uses. Integrated resource management planning promotes the use of DoD resources within certain limits so that adverse effects of mission activities are minimized and sustained reuse of natural resources is encouraged.

DoD is incorporating these activities within an ecosystem-based conservation program that allows the military greater flexibility in managing its lands. Rather than be tied to the limited objective of protecting individual endangered species, DoD is emphasizing the overall protection of existing groups of plants and animals. One example of this approach is unfolding in the Mojave Desert. (See sidebar at right.)

Use of the ecosystem approach at all DoD installations will help land managers and trainers better assess the quality of DoD lands, determine appropriate uses, assess impacts beyond installation borders, conserve areas that harbor rare or unique species, and integrate these issues with military mission requirements.

L. Peter Boice is the Director of Conservation in the Office of the Deputy Under Secretary of Defense (Environmental Security) at the Pentagon, Washington, D.C.

Mojave Desert Initiative

DoD is embracing the principles of ecosystem management on a regional scale in the Mojave Desert, DoD's premier training and testing region. Located here are such major installations as the Army's National Training Center at Fort Irwin, the Marine Corps Ground Combat Center at Twenty-Nine Palms, Edwards Air Force Base, and the Naval Air Weapons Center at China Lake. DoD conducts most of its large-scale unit training exercises and major weapons testing at these installations.

To more effectively coordinate resource management and protection in the Mojave Desert, DoD has teamed with the Department of the Interior. This regional conservation partnership will allow each department to inventory its lands, control soil erosion, and prepare management plans that recognize political boundaries but address biological integrity across these boundaries.

by J. Douglas Ripley and Michele Leslie

Defense Department's Biodiversity Initiative

In 1994, the Department of Defense (DoD) launched a Biodiversity Initiative to develop a strategy for managing biodiversity on military lands.[1] Under the leadership of Mr. Tad McCall, Deputy Assistant Secretary of the Air Force, the first step in the Initiative was to create a partnership among DoD, The Nature Conservancy, and The Keystone Center (a nonprofit organization specializing in facilitating solutions to public policy issues). The Nature Conservancy has provided scientific support throughout the effort and The Keystone Center convened a "dialogue" consisting of a series of meetings in 1995 and 1996 that involved more than 60 military and nonmilitary leaders.

To date, the Initiative has resulted in three major products:

A DoD Biodiversity Management Strategy that provides a policy framework for managing animals and plant habitats on DoD lands.

A *DoD Commander's Guide to Biodiversity*: an eight-page brochure that describes for installation commanders why biodiversity conservation is important for DoD and the nation.

A *Biodiversity Handbook for Natural Resources Managers*: A practical guide for natural resource managers on how best to conserve biodiversity conservation on their installations, with case examples at installations including Eglin Air Force Base, Florida; Camp Pendleton Marine Corps Base, California; Fort Lewis, Washington; and Point Loma Naval Complex, California.

The Keystone dialogue affirmed the important linkage between biodiversity conservation and military readiness, and outlined a model process for better integration of training and testing objectives within natural resource management strategies. Many of the resulting policy recommendations were incorporated into DoD Instruction 4715.3, *Environmental Conservation*, the basic document providing conservation policy guidance to military installations. Some examples follow:

Nellis Air Force Base

In 1993, Nellis Air Force Base, Nevada, and The Nature Conservancy of Nevada initiated a botanical inventory supported by the Department of Defense's Legacy Resource Management Program. The inventory is designed to include a comprehensive archival review of rare, threatened, and endangered plants native to this highly restricted area, followed by an intensive 4-year field survey. The research and field investigation focuses on the 3.1 million acre (1.2 million hectare) desert landscape known as the Nellis Bombing and Gunnery Range in Clark, Lincoln, and Nye Counties.

To date, based on the archival review, nearly 60 species were identified as occurring or potentially occurring on the facility. Three species are found *only* on base lands. Because of the Air Force commitment to land stewardship, this portion of Nevada's natural heritage will be protected for the future.

McChord Air Force Base

McChord AFB lies at the southern end of the Puget Sound Trough, about 5 miles (8 kilometers) south of the port city of Tacoma, Washington. Its 4,600

acres (1,860 hectares) are home to the U.S. Air Force's 62d Airlift Wing. The mission of the 62d Airlift Wing is to provide services and support that build global force protection. Yet its mission goes beyond that of the nation's defense priorities.

More than a third of the base has been protected from the explosive growth that has reshaped the Puget Sound region in the last few decades. Amid urban expansion, the demands of the timber industry, and the needs of agriculture, McChord AFB represents an important ecological resource.

In 1993, The Nature Conservancy of Washington entered into an agreement with McChord AFB calling for an inventory of ecosystems and species of concern. Since then, studies have been conducted by the Conservancy in concert with biologists from the Washington Department of Natural Resources' Natural Heritage Program.

The detailed biological inventories conducted at McChord AFB have resulted in significant findings, including the discovery of Torrey's peavine *(Lathyrus torrey)*, a plant once thought to be extirpated from Washington State, and water howellia *(Howellia aquatilis)*, a threatened plant not previously known in the Puget Sound region.

Some of the native habitats encountered–such as oak woodlands and ponderosa pine savannas–now occupy only a fraction of their original range in western Washington. For that reason, the undeveloped lands on McChord AFB represent key components in the maintenance of regional biodiversity. As new training, housing, or recreation needs arise on the base, the results of these inventories will prove invaluable to planners in protecting the base's environmental resources while also supporting its defense mission.

The DoD Biodiversity Initiative is a significant milestone for Defense Department conservation programs. It should open a new era of stewardship in which endangered species conservation will be enhanced without detriment to military readiness.

Dr. Ripley is in the Directorate of Environment for the U.S. Air Force Headquarters in the Pentagon. Ms. Leslie is with The Nature Conservancy in Arlington, Virginia.

[1] The DoD Biodiversity Initiative was formally established on August 8, 1994 by Sherri W. Goodman, the Deputy Under Secretary of Defense (Environmental Security).

Merriam's bear paw poppy (Arcotomecon merriamii) once was considered rare and in possible danger of extinction, but surveys at Neilis AFB located many additional populations on secure habitat.
The Nature Conservancy of Nevada photo

by Jeffrey L. Hardesty and Carolyn Kindell

Conserving Ecosystems at Eglin AFB

Among the most biologically significant of all Air Force lands is Eglin Air Force Base, located in the Florida Panhandle. Because Eglin's military mission includes the testing and development of weapons systems, it plays a critical strategic role in the nation's defense. At 463,000 acres (187,375 hectares), the base also is widely recognized as an important reservoir of rare plant and animal habitats.

Eglin personnel assist in a prescribed burning program, which helps mimic environmental processes. The result is a healthier forest for wildlife and commercial forestry. ***USAF photo***

Eglin contains more than half of the remaining old-growth stands of longleaf pine *(Pinus palustris)* in North America. This once vast ecosystem has been reduced by more than 98 percent across its former range. But Eglin is not an island. It is a critical link in efforts to protect and maintain regional ecosystems in concert with neighboring public and private partners. Eglin and its neighbors to the north (Backwater River State Forest, Northeast Florida Water Management District, Conecuh National Forest, Champion International Corporation, and other lands) form a large, regional ecosystem that is home to more that 160 rare or imperiled plants and animals, including some found nowhere else in the world. Among Eglin's plants and animals are nine species that are federally listed as threatened or endangered, as well as many outstanding examples of regionally important natural communities.

Eglin and its neighbors are embedded in a human landscape as well, comprised of many small cities, towns, and farms that are home to a rapidly expanding population of more than 600,000 citizens. Moreover, Eglin's natural wealth provides many important benefits to local communities, including clean water, forest products, wildlands, and a variety of recreational opportunities.

Some 59 rare plant species have been documented at Eglin and added to the Florida Natural Areas Inventory (FNAI) data base. This survey work added significantly to the known distribution of several species that are currently under review for Federal protection. According to field botanist Al Schotz, "The fact that so many plants

were observed for the first time regionally at Eglin AFB suggests that Eglin acts as a major biological reservoir for rare plant species."

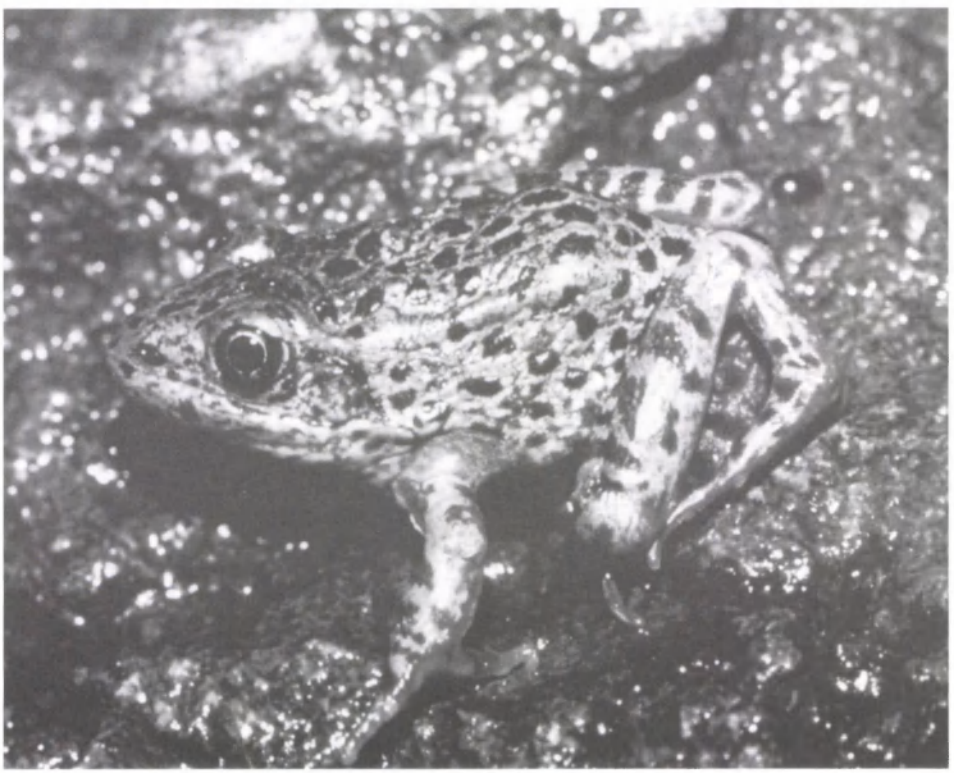
The FNAI has also completed a 3-year study of the distribution and natural history of two rare amphibians on the base, the flatwoods salamander *(Ambystoma cingulatum)* and the dusky gopher frog *(Rana capito sevosa)*. Eglin contains the largest known concentration of the frog's reproductive sites and is habitat for the salamander's most significant population west of the Apalachicola River.

Many other rare amphibians and reptiles also exist on the base, including the gopher tortoise *(Gopherus polyphemus)*, eastern indigo snake *(Drymarchon corais couperi)*, Florida pine snake *(Pituophis melanoleucus mugitus)*, alligator snapping turtle *(Macroclemys temminckii)*, Florida bog frog *(Rana okaloosae)*, pine barrens treefrog *(Hyla andersonii)*, and eastern diamondback rattlesnake *(Crotalus adamanteus)*.

The Okaloosa darter (Etheostoma okaloosae) occurs nowhere but on Eglin AFB, which has an extensive program to protect this fish.
USAF photo

Eglin's representation of the natural community types found in the Florida Panhandle is truly remarkable. FNAI ecologists estimate that at least 40 of the Panhandle's 82 natural community types can be found on the base. To date, FNAI has identified 771 occurrences of high-quality natural communities, which have been mapped and added to the database. Although field efforts so far have focused on fire-maintained community types such as sandhills and flatwoods, which cover nearly 80 percent of the base, FNAI ecologists have also paid particular attention to rare and species-rich community types such as seepage slopes, sand pine scrub, and other communities that have high conservation priority.

Base commanders and natural resource managers have made a substantial commitment to support the best possible management of Eglin's unique ecosystems. This pioneering commitment places Eglin squarely in the conservation limelight. Eglin is frequently mentioned as one of the best examples of an ecosystem-based approach to management of public lands. Department of the Interior Secretary Bruce Babbitt called Eglin "a model for the rest of the country" during his June 1995 visit to the base.



Dusky gopher frog
USAF photo

Jeffrey L. Hardesty is with The Nature Conservancy and Carolyn Kindell is with the Florida Natural Areas Inventory.

Meeting the Crucible Challenge

by John Bradley, Ph.D., and Lt. Col. Jeff Caspers

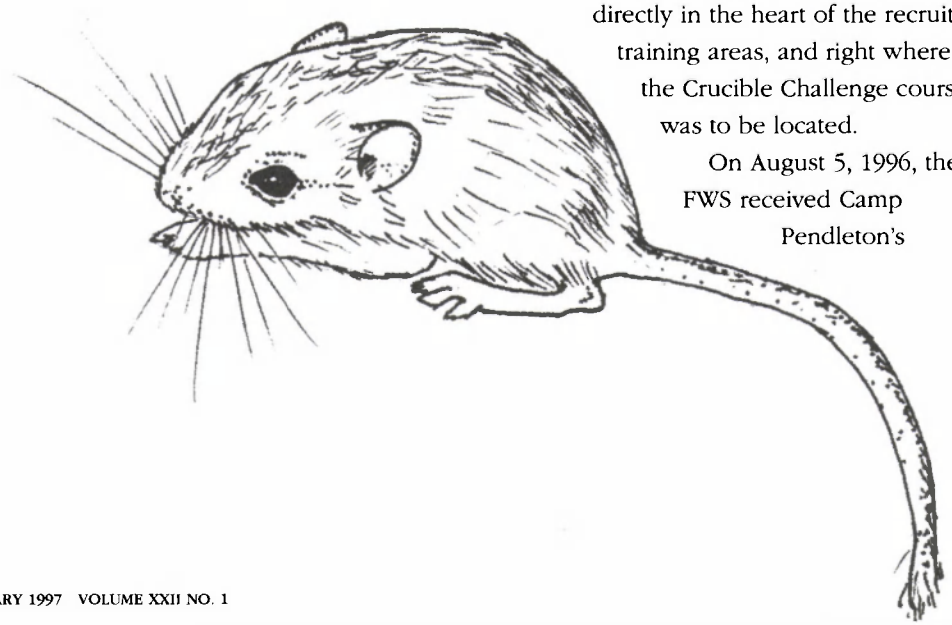
In July 1996, Marine Corps Commandant General Charles C. Krulak launched a sweeping initiative designed "to ensure that Marines have the values they need to be successful warriors and good citizens." Part of this program, a new training course for recruits, was dubbed the "Crucible Challenge." It is composed of a series of combat-oriented obstacles and specialized facilities that challenge recruits both physically and mentally during a nearly continuous 54-hour physical and mental ordeal. This course represented a challenge as well to the Fish and Wildlife Service (FWS) and the U.S. Army Corps of Engineers. Both agencies worked closely from the project's inception to help the Marine Corps locate and construct the training facilities in a way to avoid or minimize effects on rare wildlife.

Camp Pendleton, California, is the largest Marine amphibious training facility in the western United States, encompassing nearly 120,000 acres (48,565 hectares) of Pacific Ocean beaches, coastal benches, mountains, and inland valleys spread across seven major watersheds. Base management, which takes stewardship of its natural resources seriously, has worked with the FWS and other resource agencies for years to conserve one of the last remaining, natural coastal ecosystems in southern California. At the same time, Camp Pendleton has attained the distinction of having one of the highest operational tempos within the Department of Defense for military training activities. This is no ordinary feat, with more than 17 species on the base that are listed under the Endangered Species Act, proposed for listing, or candidates for listing proposals.

The endangered animal most recently found on the Base was the Pacific pocket mouse *(Perognathus longimembris pacificus)*. As late as 1992, this small mouse was thought to be extinct due to the destruction and fragmentation of its habitat along the southern coast of California. In the spring of 1993, however, it was discovered on an isolated 80-acre (32-ha) parcel on the Dana Point Headlands (just north of Camp Pendleton) during a survey related to a condominium development project. Two years later, a single mouse was discovered in the southwestern sector of Camp Pendleton near the Santa Margarita River, where it had fallen into a pitfall trap being monitored for a base-wide herpetological inventory. A few more mice soon were found at the northwestern end of the base during a survey by a local agency interested in a future highway alignment that would cross Camp Pendleton property.

The Marines were concerned about the location of the northern population on the base. If the proposed highway were approved, the actions needed to avoid jeopardizing the Pacific pocket mouse habitat could affect the base's overall mission flexibility. The Santa Margarita River specimen had been found adjacent to the primary recruit training area. In fact, further surveys indicated the existence of a relatively extensive population of the mouse directly in the heart of the recruit training areas, and right where the Crucible Challenge course was to be located.

On August 5, 1996, the FWS received Camp Pendleton's



Pacific* pocket *mouse
drawing by Karen Day

request for consultation about potential effects on the Pacific pocket mouse from the planned training facilities. The challenge intensified when the base was told by Marine Corps Headquarters to be ready prior to the first recruit company arriving at the station in early November. This meant that construction needed to begin no later than August 12!

Even though the Marines at Camp Pendleton needed to get this project implemented in short order, they knew that training activities associated with the Crucible Challenge course could result in the take of some endangered mice. Camp Pendleton officials were hopeful that they could find a way to proceed with the training course without jeopardizing the species. FWS biologists conducted surveys for the pocket mouse throughout the planned training area, along with biologists of the Navy's Southwest Division's Natural Resource Branch. The Marines also invited biologists from the FWS Carlsbad, California, Field Office to a briefing on the proposed project. The Base's Environmental Security Office had prepared a detailed resource map of the affected area with help from its Geographic Information System division. The meeting addressed potential impacts on the Pacific pocket mouse and the coastal California gnatcatcher *(Polioptila californica californica)*, constraints on project alternatives, proposed avoidance and minimization strategies, and species monitoring. The FWS was soon out on the Crucible Challenge project site for a briefing by the Marine Corps officers directly responsible for constructing the course. The locations of stations making up the Challenge Course were revised and additional measures to minimize environmental effects were incorporated into the project proposal. As a result, the FWS was able to resolve this potential endangered species conflict through the issuance of a "no-jeopardy" biological opinion to Camp Pendleton on the Crucible Challenge course.

Marine Corps recruits at Camp Pendleton confront another obstacle during the Crucible Challenge training course.
USMC photo

According to FWS biologists, the success of this Endangered Species Act consultation was possible because of the extensive groundwork laid by the Marines at Camp Pendleton and their commitment to sound resource stewardship. Such cooperative efforts between the Marines and the FWS bode well for the future of threatened, endangered, and other sensitive wildlife species on the base. In fact, the Camp Pendleton has engaged the FWS in a comprehensive, programmatic consultation to develop a long-term conservation plan for vulnerable species that could be affected by other military training activities.

Dr. Bradley is a Fish and Wildlife Biologist in the FWS Carlsbad Field Office and Lt. Col. Caspers is the Deputy Assistant Chief of Staff for Environmental Security/Natural Resources at Camp Pendleton.

by LaRee Brosseau

Marines' New Plan for Camp Pendleton

Southwestern willow flycatcher
photo © B. "Moose" Peterson/WRP

The Marines have arrived...with a plan by which their operations on Camp Pendleton, a large block of wildlife habitat amid intensive urban development in southern California, will be conducted to minimize disruption to imperiled species that also live on the Marine Corps base.

The plan focuses on beach, dune, estuary, and streamside habitats inhabited by three endangered species of birds: the least Bell's vireo *(Vireo bellii pusillus)*, the southwestern willow flycatcher *(Empidonax traillii extimus)*, and the California least tern *(Sterna antillarum browni)*· the western snowy plover *(Charadrius alexandrinus nivosus)*, a threatened species; the arroyo toad *(Bufo microscaphus californicus)*, an endangered amphibian; and the tidewater goby *(Eucyclogobius newberry)*, an endangered fish. The world's largest breeding population of the least Bell's vireo and one of the largest breeding populations of the California least tern are found on Camp Pendleton, as are significant populations of the other species. Streamside, estuary, and beach habitats represent approximately 12 percent of the total acreage.

Arroyo toad
photo © B. "Moose" Peterson/WRP

The plan implements an ecosystem approach to managing base operations and proposed projects, and was developed by the Marine Corps and reviewed by the Fish and Wildlife Service (FWS) to avoid potential conflicts between the conservation of listed species and base activities. The FWS and the Corps are working together to address the potential impacts on listed species resulting from 14 on-going and planned training activities, 6 infrastructure maintenance projects, 3 recreational programs, and 19 major and minor construction projects. The implementation of two conservation programs covering riparian and estuarine/beach ecosystems are proposed to avoid potential jeopardy to listed species. Another part of the conservation programs involves the control of harmful non-native plant species. Without management intervention, rapidly expanding infestations of invasive exotic plants will inexorably eliminate native riparian habitats, eventually extirpating least Bell's vireos and southwestern willow flycatchers from the area, greatly depleting arroyo toads, and severely degrading the quality of wetlands adjacent to the estuary/lagoon system.

The FWS has long advocated an ecosystem approach to base operations and the Marines share this vision.

LaRee Brosseau is a Writer/Editor for the FWS Ecological Services division in the Portland, Oregon, Regional Office.

Conserving Species at Fort Bragg

by Scott Bebb

Situated in the sandhills region of the North Carolina's Coastal Plain, Fort Bragg is home to the XVIII Airborne Corps, the nation's crisis response force. Stated plainly, the Corps' mission is to deploy rapidly anywhere in the world, fight upon arrival, and win. Additionally, this post supports training, installation operations, and mobilization of the U.S. Army Special Operations Command, Joint Special Operations command, the Airborne Board, and Readiness Group Bragg. Maintaining this readiness posture requires constant, intense training. This training can tax even the most resilient landscape, yet Fort Bragg contains one of the richest, most biologically diverse remnants of the once extensive longleaf pine ecosystem.

This Army installation is home to five endangered species: the red-cockaded woodpecker *(Picoides borealis)* or RCW, Saint Francis' satyr butterfly *(Neonympha mitchellii francisci)*, American chaffseed *(Schwalbea americana)*, Michaux's sumac *(Rhus michauxii)*, and rough-leaved loosestrife *(Lysimachia asperulaefolia)*. Additionally, the installation is host to a number of other rare plant and animal species that have evolved in a fire-maintained, longleaf pine ecosystem. Frequent training-caused fires in artillery impact areas, coupled with an aggressive prescribed burning program, serve to restore and maintain habitat for endangered species.

On Fort Bragg's behalf, the Army is funding a Fish and Wildlife Service biologist whose job is to coordinate RCW management and conservation efforts on private lands surrounding Fort Bragg. This program invites private landowners to participate in habitat conservation measures to aid in regional recovery. Habitat conservation planning, conservation agreements, and the recently developed Safe Harbor program are examples of these regional conservation initiatives.

A complete floral inventory of Fort Bragg by The Nature Conservancy documented over 1,100 plant species. Several of these species have their only statewide occurrence on the installation. Fort Bragg is working with the North Carolina Natural Heritage Program office to evaluate and identify areas eligible for State registry as Natural Areas. Fort Bragg also recently formed a partnership with the Center for Plant Conservation for research efforts on selected plants.

The Saint Francis' satyr, one of the rarest and least known American butterflies, occurs only on Fort Bragg. Eighty percent of the 19 known colonies occur in artillery impact areas, where frequent fires maintain the species' preferred open habitat conditions. Fort Bragg, in partnership with the Conservancy and State agencies, is developing a monitoring plan and identifying research needs for this species.

As these activities show, maintaining Fort Bragg's force capabilities while protecting rare species and fragile habitat is a challenging, yet achievable goal.

Scott Bebb is Chief of the Endangered Species Branch at Fort Bragg, North Carolina.

Fort Bragg currently supports 269 active RCW clusters, making it the core of the species' second largest population. A recently completed management plan calls for the establishment of an additional 167 clusters as Fort Bragg's contribution to a regional recovery goal. Biologists have created over 200 artificial nest cavities for the RCW, producing in a short time what would take the woodpeckers years to complete. The population is monitored through annual inspections and color banding of RCW nestlings and adults. Biologists have also begun translocating juvenile and adult RCWs into select clusters to maintain demographic linkages or augment existing groups.

A biologist drills a cavity for RCW nesting.
USAF photo

by Mary Jennings

Basic Training for Ferrets

*I*magine being born and raised in a comfortable but small cage. Your every need is met. Food is brought to you when you are hungry, the temperature is maintained for your comfort, your nest box is kept clean, you are protected from disease, and there is no risk of becoming a meal for another creature. Suddenly, you are whisked out of this secure setting and thrown into the wild. It's kind of cold and awfully big out there. Where are you supposed to live? What do you eat? If you are supposed to eat those big rodents out there, how do you do that? They fight back if you get too close! And what are all those nasty things that keep trying to eat you? Where can you hide?

A female black-footed ferret emerges from the security of a prairie dog burrow during preconditioning.
FWS photo

It may sound dramatic, but that is the scenario that faced captive-reared black-footed ferrets *(Mustela nigripes)* during the early reintroductions of this critically endangered species into the wild. In their native habitat, black-footed ferrets are completely dependent upon prairie dogs for survival, living in prairie dog burrows and consuming a diet of prairie dogs. However, most of the reintroduced animals did not know how to act as wild ferrets. In part, their skills in avoiding predators–primarily coyotes *(Canis latrans)*–were very poor. As a result, the survival rate in early ferret reintroductions was poor.

In an effort to improve survival, subsequent reintroductions included not only the "naive," cage-reared ferrets, but also those that had undergone some form of preconditioning–a process to help ferrets acquire behavioral traits that

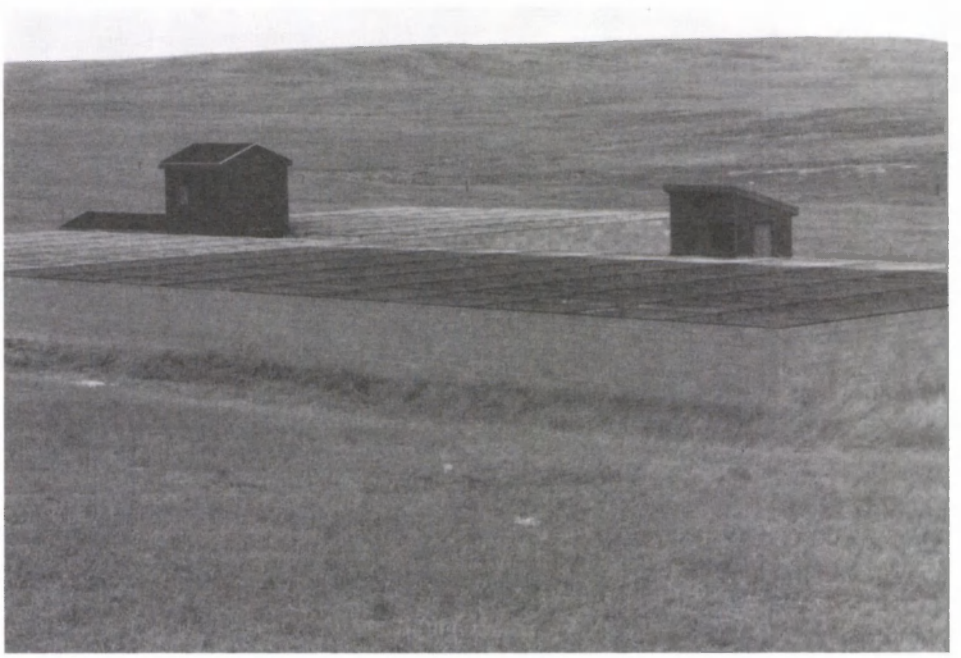
may enhance survival in the harsh prairie setting. During preconditioning, black-footed ferrets are placed in a simulated natural prairie dog town where they imprint on the security from predators that is provided by prairie dog burrows. The affinity ferrets develop for the underground environment likely results in reduced predation when they are released into the wild. They also have the opportunity to kill live prairie dogs while remaining relatively protected from disease and predation. Within the enclosure, the prairie dogs dig a system of burrows and set up housekeeping. Cage-born black-footed ferrets can be introduced at an early age into the enclosures, or breeding and whelping of ferrets can take place within the enclosures.

Preconditioning, however, presents its own set of problems. It is an additional expense for a recovery program that, like most others, has limited funding. The cost of constructing the enclosures, as well as the maintenance and operation costs associated with the facility, limited the efforts of the Fish and Wildlife Service (FWS) and its partners to provide the best possible candidates for survival in ferret reintroductions. The FWS desperately needed partnerships in the ferret preconditioning effort.

In the early 1990's, the FWS research branch asked the DoD to provide space and funding at F.E. Warren Air Force Base in Wyoming and at the Pueblo Army Depot in Colorado for construction of a black-footed ferret preconditioning facility. Using DoD Legacy Resource Management Funds, preconditioning facilities were constructed at Warren AFB and existing structures at Pueblo were modified for the effort.

Early indications are that the hard work of helping black-footed ferrets learn to be wild pays off. Behavior of preconditioned ferrets appears more appropriate for the wild, with animals spending more time underground and dispersing less than cage-reared animals. Data collected at the Wyoming and Montana reintroduction sites shows a 2.7-fold difference between survival of pen- and cage-reared ferrets, and the limited long-term survival data suggest the possibility of more than a 10-fold difference. Although some may argue the merit of drawing conclusions from such a limited data set, collectively the evidence–including behavior, short-and long-term survival, and literature regarding rearing effects on other species–indicates the value of preconditioning.

Convinced of the value of preconditioning, Tom Smith, Chief of Natural Resources at F.E. Warren, obtained additional funds for expansion of the facility in 1996. The addition effectively tripled the preconditioning capability on the base and incorporated improved design standards, making the facility one of the best in the black-footed ferret program. Through this FWS/DoD partnership, the ferret now has a better chance for recovery.



The ferret preconditioning facility at F.E. Warren AFB houses six pens with elevated observation rooms for discretely observing ferret behavior.
FWS photo

Mary Jennings is a Fish and Wildlife Biologist in the FWS Cheyenne, Wyoming, Ecological Services Office.

by Tim Wilder

Of Wings and Warriors

With a mission to train more than 100,000 Army personnel annually, Fort McCoy, Wisconsin, seems at first glance to be an unlikely haven for a rare butterfly. But since 1990, when the installation discovered the Karner blue butterfly *(Lycaeides melissa samuelis)* on its land, military training and the butterflies have coexisted, even thrived. A proactive management plan and a continuing dialogue with the Fish and Wildlife Service (FWS) have helped ensure this small creature's survival.

Fort McCoy encompasses 59,750 acres (24,180 hectares) within what is known as the Driftless Area, part of the State left untouched by glaciers. Weathering of limestone and sandstone deposits formed the rugged ridge and valley system characteristic of the area. The installation is situated within the tension zone–a relatively narrow band across Wisconsin that separates the northern coniferous forests from the central deciduous forests–and within the transition zone between the western prairies and the eastern forests. Because of its location, Fort McCoy is home to a diversity of vegetation, including wild lupine *(Lupinus perennis)*–the only known host plant for Karner blue larvae.

Fort McCoy began its efforts to protect the Karner blue nearly 2 years before the butterfly was listed as an endangered species in 1992. After being informed of the butterfly's declining status in 1990, Fort McCoy planned surveys to determine the distribution of Karner blues and wild lupine. The surveys, which were conducted from 1991 to 1994, mapped more than 3,800 acres (1,540 ha) of lupine. About 94 percent of this lupine habitat was occupied by Karner blues. Fort McCoy officials began coordinating with the FWS on the impact of both military and non-military activities affecting the Karner blue in 1992, and in early 1994 the FWS issued the post a no-jeopardy Biological Opinion. The document included "reasonable and prudent measures" and "terms and conditions." As part of its effort to fulfill those terms, Fort McCoy submitted a draft Karner Blue Butterfly Conservation Plan to the FWS in 1995. The plan outlines the direction Fort McCoy will take to manage the Karner blue, while at the same time allowing for the successful completion of the installation's military training mission. The final conservation plan will be completed in 1997.

Numerous research projects on the Karner blue and its habitat continue at Fort McCoy. Projects begun in 1993 to assess the impacts of the current disturbance regime (military training, occasional fires, forest management) are particularly noteworthy. Wild lupine thrives on occasional habitat disturbance, which creates optimal seedbed condi-

Karner blue butterfly
photo © John and Karen Hollingsworth

tions. Activities that can create these conditions include disturbances from military training, logging operations, fire, and mowing. Through agreements with the FWS, military activities disturb a portion of the installation's Karner blue habitat each year. To monitor the disturbance, biologists survey 65 study plots several times throughout the year. Information obtained from these surveys is used to estimate the total amount of disturbance occurring within Karner blue habitat. A mark-release-recapture study, conducted in 1994, helped installation personnel determine Karner blue dispersal distances and provided a population estimate for the study area.

Not all disturbance is beneficial to the Karner blue. In May 1996, the post established 11 core areas to ensure that key habitat areas are protected from levels of disturbance that would harm the butterfly's habitat. The establishment of these core areas does not mean that they will not be disturbed, but that land managers will determine when disturbance should occur.

Educating soldiers, civilian employees, and all who use the installation's lands about the butterfly and its habitat has been a vital dimension of the Karner blue program at Fort McCoy. Examples of education efforts include briefing unit leaders about endangered species concerns prior to field training and providing soldiers with maps of Karner blue habitat. Personnel also receive pocket-sized cards depicting wild lupine.

In managing for the Karner blue, Fort McCoy has been able to comply with the Endangered Species Act while experiencing minimal impact on its military training mission. Since many activities occurring at Fort McCoy create and maintain the proper mix of habitat required by the species, the future looks bright for the Karner blue on the installation. Continued monitoring of the butterfly and its habitat will ensure that both soldiers and Karner blues can coexist on Fort McCoy's landscape far into the future.

Tim Wilder is the endangered species biologist at Fort McCoy, Wisconsin.

by Tim Merritt and
Brad Bingham

Engineering a Partnership

In this era of shrinking budgets, conservation partnerships are becoming increasingly necessary. Recognizing this fact, the Department of Defense's (DOD) Arnold Engineering Development Center (AEDC), the Fish and Wildlife Service (FWS), and The Nature Conservancy (TNC) have come together to identify, protect, and enhance AEDC's natural resources. According to David Campbell, Director of Stewardship for the Tennessee Chapter of TNC, "AEDC is a hot spot for biological diversity." Approximately 88 percent of its 39,081 acres (15,828 hectares) remains largely undeveloped.

Eggert's sunflower benefits from prescribed burning, which controls competing plants and allows more light into the habitat.
photo by Dennis Horn

AEDC is an Air Force installation located in Coffee County, Tennessee. Recent surveys have identified 68 species that are considered by the State or FWS as endangered, threatened, or vulnerable. Among them are the endangered gray bat *(Myotis grisescens)* and Eggert's sunflower *(Helianthus eggertii)*, a plant proposed by the FWS for listing as threatened. In an effort to manage the facility on a more holistic level, AEDC established a core team in 1995 to assist in the development of an installation-wide ecosystem management plan. The Air Force asked a diverse group of conservation organizations and State and Federal agencies to participate in identifying and enhancing those characteristics that set AEDC's ecosystem apart.

One important aspect of the ecosystem is its barrens habitat: a grass-dominated area with a sparse growth of scrubby trees. This habitat type supports several rare species, including Eggert's sunflower. To prevent potential conflicts with normal installation operations, the Air Force and FWS are working together on a plan to restore and conserve barrens habitat. This ecosystem-based initiative would benefit not only the sunflower but also several State-listed species and neo-tropical birds, such as the grasshopper sparrow *(Ammodramus savannarum)*, prairie warbler *(Dendroica discolor)*, and Bewick's wren *(Thryomanes bewickii)*.

Gray bats use some very different types of habitat on the facility. For a portion of the year, they forage for insects along the 3,980-acre (1,612-ha) Woods Reservoir, an impoundment of the Elk River. To the surprise of many bat experts, 300 to 500 gray bats also use the dam itself as a roosting site. According to Dr. Michael J. Harvey, a Tennessee Technological University professor, "Woods Dam is one of the very few non-cave sites where gray bats have been observed roosting." The dam contains equipment rooms with open sides, thus giving the bats free passage. Mark Moran, AEDC's Coordinator of Natural Resources, notes that "...the bats utilized the two outer rooms for the most part. One room is used as a maternity colony by the females while the other is used as a bachelor colony by the males." Although there may be some overlap during portions of the year, the males and the females remain segregated as a rule. To many, this organizational scheme may seem strange when they are separated by only a few yards.

The Air Force and FWS have worked cooperatively to accommodate gray bat usage of the dam during required dam maintenance activities. "Surprisingly enough, they seem to be able to coexist," said Dr. Lee Barclay, supervisor of the FWS Cookeville, Tennessee, Field Office. Most maintenance work is completed during the winter when the bats are gone, and environmentally conscious managers take care to minimize activities during those periods when the bats are present. A comprehensive management plan is being developed by the Air Force and the FWS to address future management needs.

Another example of common interest can be seen in AEDC's numerous wetlands. Since 1991, the FWS has worked with the Air Force to identify and map the installation's wetland resources. Using FWS National Wetlands Inventory maps as a guide, 3,400 acres (1,375 hectares) of wetlands were identified.

As DOD and the FWS continue to downsize, conservation partnerships such as ours make good resource sense and are fiscally responsible. We strongly encourage other FWS offices, as well as other Federal and State agencies, to work together with DOD installations in their areas.

Tim Merritt is a fish and wildlife biologist and Brad Bingham is a fish and wildlife biologist/outreach specialist in the FWS Cookeville Field Office.

by Mark H. Sherfy

Working Together for Sumac Recovery

Until a few years ago, Michaux's sumac *(Rhus michauxii)*, a low-growing shrub in the cashew family, was known only from scattered sites in Georgia and North Carolina. But a 1993 survey by the Virginia Division of Natural Heritage revealed that the species was also present, and thriving, at Fort Pickett, a U.S. Army training facility near Blackstone, Virginia.

Fort Pickett's fish and wildlife management staff has fostered a strong relationship with the FWS, and has worked closely with the Virginia Division of Natural Heritage in monitoring population status. Protection and enhancement of Michaux's sumac colonies is among the highest priority land management issues for the base. The Fort Pickett biologists will play a critical role in maintaining the success of this population.

Michaux's sumac prefers sunny habitats and cannot tolerate shade. Because it favors open areas, such as fire-maintained plant communities, this species is widely distributed throughout firing ranges and impact areas at Fort Pickett. Most of the colonies are within a 4,251 hectare (10,504-acre) buffer zone for small arms, tank and artillery ranges that burns every year or two.

Dominant plant species in the two main community types supporting Michaux's sumac at Fort Pickett are: 1) a southern red oak *(Quercus falcata)*, white oak *(Quercus alba)*, sweet gum *(Liquidambar styraciflua)*, and mockernut hickory *(Carya tomentosa)* overstory, with a little bluestem *(Schizachyrium scoparium)* understory; and 2) mockernut hickory and black oak *(Quercus velutina)* overstory, with a little bluestem, Chinese bushclover *(Lespedeza cuneata)*, and Michaux's sumac understory. Michaux's sumac does occur in other habitats at Fort Pickett, especially in areas where disturbance has been moderate to severe, but it is only within these two principal communities that colonies reach appreciable size.

The primary means of reproduction for Michaux's sumac is asexual, spreading by rhizomes (underground stems). Sexual reproduction does occur but is limited by the distribution of male and female plants. Of the 27 colonies examined during a recent study at Fort Pickett, plants containing male and female flowers occurred in only nine. Of these nine, seven were in the mockernut hickory-black oak community. Because preliminary data suggest that sexual reproduction of Michaux's sumac is more commonplace in this plant community, management for genetic diversity of this species should focus on identification, protection, and enhancement of appropriate mockernut hickory-black oak habitats.

Colonies that depend on rhizomatous or clonal reproduction expand when some sort of activity opens up the habitat. The two main factors contribut-

Army natural resources personnel at Fort Pickett, Virginia, and Fort Bragg, North Carolina, are working to conserve the Michaux's sumac.
photo courtesy of FWS Chesapeake Bay Field Office

ing to rhizomatous reproduction are fires and physical disturbance of the soil. Colonies have been found in craters from old artillery impacts, edges of abandoned roads, and spoil piles. Fires and other disturbances resulting from military operations have apparently maintained appropriate Michaux's sumac habitat throughout the installation.

At present, the Fort Pickett population is estimated to number about 50,000 stems. (Botanists count stems because of the difficulty in distinguishing individual Michaux's sumac plants.) Successful management of the Fort Pickett population has depended on strong working relationships among academic institutions and state and Federal agencies. The U.S. Army's Integrated Training Area Management program has played a significant role in assessing population vigor, identification and delineation of Michaux's sumac colonies, and monitoring changes in the species' distribution. In addition, the program has developed geographic information system (GIS) mapping for assessing annual trends in plant distribution and for planning future projects.

With the support of the Fish and Wildlife Service (FWS) and the Department of Defense, researchers from Virginia Polytechnic University and the University of Georgia are studying the Michaux's sumac population at Fort Pickett. A study aimed at determining the degree of hybridization with a related species, the smooth sumac *(Rhus glabra),* will aid the recovery effort by identifying colonies of pure Michaux's sumac and describing genetic diversity within the population as a whole. Researchers have also conducted a study of propagation techniques.

The FWS Chesapeake Bay Field Office has worked closely with Fort Pickett in assessing the effects of military training operations on Michaux's sumac colonies and has encouraged the Army to maintain existing disturbance levels where expansion of existing colonies or establishment of new colonies is likely. Future efforts will be directed at assessing the frequency and level of disturbance necessary to maintain the overall population. Continued cooperation between the Department of Defense and the FWS is vital to the recovery of this endangered plant species.

Mark H. Sherfy is a biologist with the FWS Chesapeake Bay Field Office in Annapolis, Maryland.

by James Reid

Navy Tracks Manatees with Satellites

Chessie, a West Indian manatee *(Trichechus manatus)*, made the national news as interest arose about his travels from Florida to New England in the summer of 1995. Last summer, satellite-monitored tracking gear on Chessie again recorded his unusual migration. Through the use of this technology, we learned about his patterns of movement and habitat use.

The manatees' presence at the Roosevelt Roads Naval Station provides many good educational, research, and public relations opportunities without conflicting with the military mission. As part of another Legacy project, the Navy and the Puerto Rico Department of Natural and Environmental Resources built a manatee viewing complex at the installation. It includes an interpretative display, a boardwalk, and a tower with viewing scopes. Educational material on the West Indian manatee in both Spanish and English has been developed by the Station's natural resources managers. This material is part of a teacher's packet for visiting school groups and interested naval employees and their families.

But Chessie isn't the only manatee whose movements have been monitored. The Department of the Interior's Sirenia Project has been conducting research on manatees in and around Florida since 1974. West Indian manatees can also be found throughout the Caribbean, Central America, and the northern waters of South America. Although this endangered mammal inhabits the waters of Puerto Rico, protection efforts there have lacked the information on movement patterns and habitat preferences needed to develop effective management strategies. This need guided the Sirenia Project to initiate manatee radio-tracking studies in Puerto Rico.

Puerto Rico's natural areas are rapidly giving way to urban development, with mangrove forests and seagrass beds being lost or degraded due to coastal development. Manatees spend about five to eight hours a day feeding on seagrass and other aquatic vegetation, consuming amounts up to 11 percent of their body weight daily. Aerial surveys in Puerto Rico have documented high concentrations of manatees near the U.S. Naval Station at Roosevelt Roads, where much of the aquatic vegetation has been undisturbed by naval operations. Curiously, manatees may be found within the undeveloped coastal waters along several U.S. Navy bases. In fact, the restricted waters on these naval bases, where manatees can avoid harassment and most recreational boater traffic, have become *de facto* sanctuaries for manatees and other marine life. The manatee population around Roosevelt Roads is a prime example, and this location is ideal for radio-tracking studies on manatees.

In 1992, the Sirenia Project--then part of the Fish and Wildlife Service (FWS)--teamed up with the Roosevelt Roads Naval Station, FWS Caribbean Field Office, Puerto Rico Department of Natural and Environmental Resources, and Caribbean Stranding Network (CSN) to radio-tag and monitor individual manatees using satellite-based techniques. With the addition of funds from the Department of Defense's Legacy Resource Management Program, the effort was the first radio-tagging of West Indian manatees outside the continental United States.

A total of seven free-ranging adult manatees were captured at Roosevelt Roads, radio-tagged, and released. A buoy containing a satellite-monitored transmitter was tethered to a belt around the tail of each manatee. While the manatees were feeding or resting in

shallow water, signals from the floating transmitters could be received by polar-orbiting satellites. Locations and sensor data could be accessed by project personnel through computer and modem connections. Using conventional VHF tracking techniques, manatees were periodically located and observed by biologists in the field.

The nearshore waters of Roosevelt Roads were used by most of the manatees throughout the four-year study. Four of the individuals, however, demonstrated that manatees are capable of long-distance movement across open water by periodically moving between the main base to a preferred feeding area around Vieques Island, approximately 10 kilometers (6.2 miles) away. The tagged manatees also demonstrated a preference for *Halodule wrightii* seagrass beds, and sought out this seagrass for forage despite its infrequent occurrence in the study area.

Results from the tracking study suggest that the expansive seagrass beds on and adjacent to Roosevelt Roads are of critical importance for manatee survival in eastern Puerto Rico. To document these resources, the Sirenia Project used high-quality color aerial photographs provided by the Navy to map the distribution of nearshore habitats. The findings from both the radio-tracking and mapping efforts are now being used in the development of effective management strategies for the Station's natural resources management plan, and for the West Indian Manatee Recovery Plan for Puerto Rico.

The Roosevelt Roads Naval Station also served as the release point for returning a manatee to the wild. A two-week old manatee was rescued in 1992 and raised by the CSN. When he had grown to over six feet in length, CSN biologists wanted to return him to the wild. Due to the support offered by the station and its volunteers, along with availability of good habitat, Roosevelt Roads was selected as the release site. This manatee has now become a member of the Station's resident population.

The Sirenia Project has also cooperated with the Georgia Department of Natural Resources and the Navy to radio-track manatees at the King's Bay Naval Submarine Base in southern Georgia. Kings Bay is in the northern range of the Florida manatee, and habitat use patterns there are quite different from those observed in southern Florida. Determining the movements and habitat use patterns at King's Bay and Roosevelt Roads will enable base resource managers to better make informed decisions concerning coastal uses and vessel operations.

James P. Reid is with the Sirenia Project, which continues its research on manatees as part of the U.S. Geological Survey's Biological Resources Division.

This radio-tagged manatee is ready for release.
Sirenia Project photo

by Lee Andrews

Partnering with the Army in Georgia

Over the past 10 years, the Fish and Wildlife Service's (FWS) Brunswick, Georgia, Ecological Services Field Office has developed partnerships with the Department of Army to assist with a wide array of threatened and endangered species issues in Georgia. The relationship these two agencies now share has evolved from one where mutual misunderstanding was common to one where both agencies are actively working together on various management issues.

Initial Cooperation

The present relationship between the Army and the FWS in Georgia began in the early 1990's with an agreement to complete a comprehensive survey of listed and candidate plants and animals at Fort Gordon. The survey effort was completed by FWS biologists with assistance from the Botany Department at the University of Georgia. It lasted 2 years and identified locations for 14 listed species, including the red-cockaded woodpecker *(Picoides borealis)* or RCW and bald eagle *(Haliaeetus leucocephalus)*, and several other species under consideration for legal protection.

The initial work at Fort Gordon established two important precedents. First, the Army and the FWS established a baseline of species knowledge at Fort Gordon that would allow both agencies to provide better management and review for future projects. Second, the survey work at Fort Gordon led to the FWS pursuing cooperative agreements on other military bases. One result was an important cooperative agreement with Fort Benning, a 186,000-acre (75,275-ha) Army installation located in Alabama and Georgia near the City of Columbus, Georgia.

Fort Benning Endangered Species Survey

The Fort Benning Endangered Species Survey began in 1994 and will, upon completion, provide the species habitat and distribution data necessary for Fort Benning Natural Resources Management Branch biologists to

Gopher tortoise
USAF Photo

complete an Integrated Natural Resources Management Plan. Initially, the Survey received $970,000 from the Army to provide technical assistance and conduct a survey for rare plants and animals over a 3-year period. A short time later, the Army awarded the Survey an additional $125,000 to conduct an inventory of Fort Benning's aquatic sites for fish and freshwater mussels, extending the overall project effort for at least one more year.

Federally-listed species are the priority for the survey effort, and 20 such species may occur on Fort Benning. Among these are the gopher tortoise *(Gopherus polyphemus)*, southern bald eagle, wood stork *(Mycteria americana)*, red-cockaded woodpecker, and relict trillium *(Trillium reliquum)*. Including the 20 potentially-occurring federally-listed species, surveys are targeted for 102 plants, 11 amphibians, 15 birds, 15 mammals, 14 reptiles, 10 fish, and 5 freshwater mussels.

The Survey has completed 2 years of a scheduled 4-year survey effort. Among the important findings have been:

- two new sites for the relict trillium;
- the location of several previously-unknown RCW cavity trees; and
- the location of more than 6,100 occurrences of federally- or State-listed species–nine plants, three amphibians, six birds, five fish, one mammal, and seven reptiles–using the Global Positioning System (GPS).

All species location data collected using GPS equipment is transferred to Geographic Information System (GIS) format and released as soon as possible to Fort Benning biologists. They can then use the data to review the potential impacts of proposed military training activities on the base's wildlife resources. The GIS location data may also prove helpful for predicting additional locations of listed species on Fort Benning.

The Survey could not achieve its goals without the continuing support and involvement of Fort Benning commanders. All levels of Fort Benning's leadership are briefed on survey progress and are consulted when potential land management or endangered species conflicts are identified by the FWS biologists stationed there. Cooperation among military and civilian officials has been excellent, and there are plans to continue the FWS presence on Fort Benning to provide more day-to-day technical assistance and address trust resource needs in the Northeast Gulf Ecosystem.

Red-cockaded woodpecker
photo © John and Karen Hollingsworth

Fort Benning contains a diverse assemblage of habitats, including hardwood bluff and ravine forests, fall line scrub sandhills, longleaf pine forests, bottomland hardwood forests, and many intermediate habitat types. The presence of so many different habitat types means that many species are likely to be discovered and that field survey methods must be flexible enough to cover such a large area. Two general survey methodologies were employed. The first is a parallel line-transect survey of large blocks of relatively uniform habitat(s). This method is useful in locating animals like the gopher tortoise and Bachman's sparrow *(Aimophila aestivalis)* and plants such as *Agrimonia incisa*, a member of the rose family. The second method uses intensive searches of preferred or suitable habitats for specific species or species groups. For example, surveys typical of this methodology include the use of a backpack electrofisher to sample fish, construction of herpetofaunal arrays to sample breeding amphibians, and intensive habitat searches to locate flowering plants such as the relict trillium.

Virgil Lee Andrews, Jr., is a Supervisory Fish and Wildlife Biologist at Fort Benning in a detached field station of the FWS Brunswick, Georgia, Ecological Services Office.

by Barbara A. Simon

Working with the Navy in San Diego

Since 1994, a partnership has been evolving between the Carlsbad, California, Field Office of the U.S. Fish and Wildlife Service (FWS) and the Natural Resources Management Branch of the Navy's Southwest Division Facilities Engineering Command in San Diego, California. It has become instrumental in successfully resolving problems that arise between the FWS and the Navy over implementation of the Endangered Species Act.

Currently, 34 federally-listed or proposed species of plants and animals are found on the 2.9 million acres (1.2 million hectares) of Department of Defense land within the Southwest Division. The necessity of establishing a strong working relationship between agencies was recognized by Gail Kobetich, Field Supervisor of the Carlsbad Field Office, and Mike Stroud, Manager of the Southwest Division's Natural Resources Management Branch. The cooperation they have since worked to attain was not unprecedented. They had worked together previously on a successful salt marsh harvest mouse *(Reithrodontomys raviventris)* project at Mare Island Naval Shipyard in Vallejo, California. Eventually, that facility became part of the Don Edwards San Francisco

California least tern
photo © B. "Moose" Peterson/WRP

The shooting star, a wildflower with vivid pink blossoms, is found in plant communities surrounding vernal pools.
FWS photo

Bay National Wildlife Refuge. The salt marsh harvest mouse is one of its most abundant residents.

"The partnering program has worked extremely well," Kobetich says. "Individuals have gotten to know one another and the lines of communication are open. Valuable staff time has been saved on issues that can be resolved quickly."

The partnership has produced many successes. For example, personnel from the Seal Beach Naval Weapons Station and the FWS built 30 new artificial nesting platforms in 1995 that biologists believe will increase populations of the endangered light-footed clapper rail *(Rallus longirostris)*. At the Navy's Fallbrook facility, a recently completed sensitive and endangered species survey will be used in developing a fish and wildlife management plan for the site.

At the close of a recent meeting at Coronado Naval Air Station, more than 30 attendees toured California least tern *(Sterna antillarum browni)* and western snowy plover *(Charadrius alexandrinus nivosus)* nesting sites at Delta Beach–which is also the site of the Navy's eel grass *(Zostera marina)* restoration project–and the Navy's Radio Receiving Facility. There, a project is underway to remove exotic plants that threaten the rare Nuttall's lotus *(Lotus nuttalianus)*, a native plant that was once abundant in the area.

Much of the California least tern habitat at Coronado lies at the center of the Navy's training grounds. Protecting these areas from activity is a continuing challenge. Biologists from both agencies have worked together for over 10 years to research, monitor, and improve the least tern sites. Despite some disagreements, they have always found a way to work out the difficulties.

As the San Diego area continues to grow and the Navy consolidates facilities in the area, stresses on habitat, endangered species, and the people who protect them will multiply. Soon, Miramar Naval Air Station, which has 80 percent of San Diego County's remaining vernal pools, will become a Marine Corps air station. FWS and Natural Resources Management staff have long worked together to conserve vernal pools and to protect the species that inhabit these rare and unusual phenomena. The process has proven so useful that the Carlsbad Field Office has formed similar partnerships with the Army Corps of Engineers and the California Department of Fish and Game.

Barbara Simon is a FWS Information and Education Specialist at the San Diego Refuge Complex in Imperial Beach, California

by Stephen Duke

Kootenai River White Sturgeon Recovery Plan

Approximately 10,000 years ago, during the last glacial age, a natural barrier at Bonnington Falls downstream of Kootenay Lake in Canada isolated a population of white sturgeon *(Acipenser transmontanus)* in the Kootenai River drainage from other white sturgeon in the Columbia River basin. This newly land-locked population adapted to the pre-development habitat conditions in the Kootenai River drainage, moving freely between Kootenay Lake (in Canada) and the Kootenai River (Idaho and Montana). Reproducing adults migrated into the Kootenai River to spawn during the peak flow period that historically occurred from May through July of each year.

The Kootenai River population of white sturgeon was listed as endangered on September 6, 1994. This unique stock has been in decline since the mid-1960's. Human activities have changed the natural flow patterns of the Kootenai River, altering the sturgeon's spawning, egg incubation, nursery, and rearing habitats, and reducing overall productivity. Operation of Libby Dam since 1974 is considered to be a primary reason for the population's continued decline. When Libby Dam began regulating the Kootenai River, average spring peak flows were reduced by more than 50 percent, and winter flows were increased by 300 percent. This means that the natural high spring flows required by white sturgeon for reproduction now occur only rarely during the spawning season. By 1990, the population was estimated at approximately 880, with few fish less than 20 years of age.

The Fish and Wildlife Service (FWS) released a draft recovery plan for the Kootenai River population of white sturgeon on July 2, 1996, for public comment and peer review. It was developed by a recovery team composed of persons representing eight

Kootenai River white sturgeon
photo provided by Kim Apperson, Idaho Department of Fish and Game

State, Federal, Tribal, and Canadian agencies who have experience with the Kootenai River white sturgeon or the threats it faces. Two Canadian representatives were appointed to the team to facilitate recovery efforts in British Columbia, where much of the white sturgeon's habitat occurs.

The draft plan calls for various conservation measures to prevent extinction and reestablish natural recruitment. Proposed recovery actions include using hatchery propagation and providing additional Kootenai River flows. Due to uncertainties in egg-through-yearling survival for wild white sturgeon and the general lack of recruitment since the mid-1960's, hatchery-produced fish will be released into the Kootenai River, and possibly Kootenay Lake in British Columbia, during each of the next 10 years. The recovery team also identified specific criteria that, if achieved, may allow downlisting of the Kootenai River white sturgeon population to threatened status after 10 years. The team drafting the recovery plan also considered the requirements of other fish species, including the bull trout *(Salvelinus confluentus)*, a listing candidate, and recreational fisheries within the Kootenai River drainage. Proposed recovery actions for the white sturgeon should complement measures designed by the National Marine Fisheries Service for Snake River chinook and sockeye salmon species *(Oncorhynchus tshawytscha* and *O. nerka*, respectively), which rely on Kootenai River water to meet recovery objectives downstream in the Columbia River.

Specific white sturgeon recovery criteria will be developed as new information is collected on population status, life history, and Libby Dam flow augmentation. However, the FWS estimates that 25 years will be needed following implementation of a final recovery plan before delisting of the white sturgeon population can be considered. Twenty-five years is the approximate period for juvenile white sturgeon, whether added artificially or naturally to the population, to reach maturity and complete a new spawning cycle.

Recovery of the Kootenai River white sturgeon will also require improved coordination between United States and Canadian governmental and non-governmental organizations. Numerous programs to address Kootenai River Basin issues are already underway through local, State, Tribal, and Federal entities in the United States and Canada. For example, the FWS has been working with the U.S. Army Corps of Engineers, Bonneville Power Administration, the Kootenai Tribe of Idaho, Idaho Department of Fish and Game, and Montana Department of Fish, Wildlife and Parks since 1992 to develop an experimental flow and monitoring program to identify factors limiting successful reproduction of this species. Improved interagency coordination will ensure that these and future programs are compatible with recovery objectives proposed for the Kootenai River white sturgeon. Additionally, the recovery team identified the possible need for a United States-Canada agreement to facilitate Kootenai River white sturgeon recovery efforts throughout its range, similar to the agreement reached for the whooping crane *(Grus americana)*.

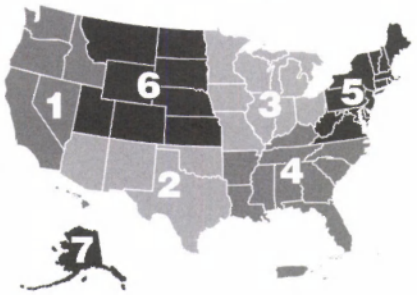
Stephen Duke is Supervisory Biologist with the FWS Snake River Basin Office in Boise, Idaho, and recovery team leader for the Kootenai River white sturgeon.

ON THE WEB

International Affairs Programs On-line!

The Fish and Wildlife Service's (FWS) international programs are now represented on the World Wide Web. Look under the FWS homepage—just go to http://www.fws.gov and search by office—for the latest newcomer: International Affairs. A click or two of the mouse and you'll be able to surf the world of FWS International activities.

Everything from fact sheets to photos, with a variety of information related to international wildlife treaties and conventions, went live February 7. Are you interested in resolutions submitted by the United States to CITES? Then browse the coverage of the 10th Conference of the Parties to be held in Zimbabwe this June. Want to know more about what the FWS is doing in India? Search through Global View for the latest news. Information on travelling with pet birds, obtaining permits for leopards and elephants, and much more is a mouse-click away. So explore the FWS International Affairs page, now at an Internet site near you!



Region 1

Western Snowy Plover ***(Charadrius alexandrinus nivosus)*** About 200 of these threatened shorebirds nest on beaches at Vandenberg Air Force Base, California, and about the same number winter in the same areas. The beaches also support a variety of recreational activities, such as surfing, fishing, swimming, picnicking, horseback riding, jogging, beach combing, sunbathing, and bird-watching. Base officials and the Fish and Wildlife Service (FWS) have developed a management plan that:

- protects western snowy plover nesting habitat on all of Vandenberg Air Force Base beaches, establishes corridors that allow beach users access to lower beach areas without disturbing nesting plovers in the upper dunes,
- provides educational signs and public contact, and
- restricts off-road vehicle use on the beach to Air Force security patrols associated with rocket launches.

Western snowy plover
photo © B. "Moose" Peterson/WRP

Desert Tortoise ***(Gopherus agassizii)*** The FWS and Naval Air Weapons Station China Lake at Ridgecrest, California, have developed a program that expedites the Navy's environmental review process and conserves habitat for the threatened Mohave population of the desert tortoise. Under this program, the Navy will limit projects in areas that support higher numbers of desert tortoises to disturbance of less than 2.5 acres (1 hectare) per project. The program also established desert tortoise avoidance and protection measures for projects throughout the facility. A review of activities conducted under this program will be completed at the end of each year.

Pacific Species The FWS Pacific Islands Office has had a long history of working cooperatively with various Department of Defense agencies to promote the conservation of listed species. In one example, the FWS has entered into agreements with the Army to transfer $1.5 million in funding for projects over 5 years to protect listed species on Army lands, including the palila *(Loxiodes bailleui)*, an endangered bird; the endangered O'ahu tree snails *(Achatinella* ssp.*)*, and many endangered and threatened plants. These projects are located on O'ahu at the Makua Military Reservation, Schofield Barracks Military Reservation, Kawailoa Training Area, and Kahuku Training Area, as well as on the Big Island at the Pohakuloa Training Area. In addition, the FWS is assisting with development of the Army's Ecosystem Management Program on these installations. The development of fire management plans, alien weed control, ungulate control, and fencing have provided important opportunities to protect Hawaii's unique resources on these large Department of Defense lands.

Navy involvement with the FWS has provided considerable funding for status surveys and for the monitoring of sea turtles and listed birds on remote islands in the Pacific (including Tinian, Rota, and Saipan) where military training is prevalent. The Air Force also worked with the FWS on the development of Integrated Natural Resources Management Plans on Air Force lands, including Anderson Air Force Base on Guam. Additionally, the Marine Corps is working with the FWS to recover Hawaii's endangered waterbirds on its installation at Kane'ohe at the Nu'upia Ponds.

The FWS is working cooperatively with other Department of Defense installations on base closures in the Pacific, including clean-up activities on the remote islands of Howland, Baker, Jarvis, and Palmyra; the Kaho'olawe clean-up and restoration program; and the Solomon Islands mustard gas removal. The Navy recently received a special award for its outstanding record on the protection of wildlife and historic resources on Midway Atoll and its exceptional cooperation in the transfer of the island to the FWS as a national wildlife refuge.

Salmon The 6th Annual Wenatchee River Salmon Festival was held September 19-22 at the Leavenworth National Fish Hatchery Complex, located near the Bavarian-theme town of Leavenworth, Washington. Nearly 9,000 visitors attended the event, which is co-hosted by the U.S. Forest Service (Wenatchee National Forest) and the FWS. The festival has received numerous awards for educational excellence, service, and creativity. One of this year's new attractions was the Hatchery Society's Spawn Shop, which offered unique gifts relating to natural resources. Visitors who wanted to see wild salmon and learn about healthy habitat could take a tour of the waterfront.

A huge success this year was the Intertribal (American Indian) Encampment, filled with cultural displays for all ages. The Salmon Tent storytelling with Cascade High School Drama students narrating Coyote legends was enchanting. Young people had a wild time with the environmental education game, Macroinvertebrate Mayhem. The Web of Life costume game is another event popular with the kids. At a Chalk Art demonstration held on the sidewalk, community artists drew wildlife images with vibrant pastel chalks. Each square represented one of the Salmon Festival "spawnsors." The multi-agency exhibits also were excellent this year. The Icicle Creek Chapter of Trout Unlimited hosted a popular booth where visitors could try catching a large salmon through computer simulation.

If you missed the Salmon Festival this year, be sure to put it on your list of good things to do in 1997 (September 18-21). Contact Corky Broaddus at 509/548-7641 for more information about this event.

Region 2

Crane Reintroduction "Teaching Cranes to Migrate," an article in *Bulletin* Vol. XXI No. 5, described the experimental use of ultra-light aircraft in teaching migration routes to captive-bred cranes after their release into the wild. The testing of this technique continued recently when eight individuals of a non-endangered subspecies, the greater sandhill crane *(Grus canadensis tabida)*, were led about 750 miles (1,200 kilometers) from southeastern Idaho to central New Mexico. The migration took almost 16 days, with the aircraft grounded for 6 days due to winter storms in the mountains. Although the flock had four encounters with golden eagles *(Aquila chrysaetos)*, no cranes were injured. The cranes are expected to spend the winter at Bosque del Apache National Wildlife Refuge.

Two of the sandhill cranes led in southward migration by ultralights in the fall of 1995 migrated back to Idaho in the spring of 1996. The cranes were last seen in southern Colorado, apparently en route back to Bosque del Apache NWR, where they spent last winter If the results of the research continue to be favorable, the FWS and Kent Clegg, who is conducting the project under contract, plan to test the technique on whooping cranes *(Grus canadensis)* in 1997. Ultimately, the technique may be used to establish a whooping crane flock that would nest in Canada's southern prairie and winter in the eastern United States.

Region 3

Gray Wolf *(Canis lupus)* Wolf recovery continues to progress in the upper Midwest. From 1960 to 1975, Wisconsin apparently had no breeding population of gray wolves. But shortly after Federal protection was extended to the eastern timber wolf in Minnesota in 1974, wolves began reestablishing themselves in Wisconsin. The Wisconsin Department of Natural Resources, with assistance from the FWS, began a monitoring program in 1979, a time when the State had about 25 wolves in 5 packs. Wisconsin's wolf population has increased steadily since the 1985-87 winter surveys; the 1995-96 winter surveys confirmed 28 packs and about 100 wolves in Wisconsin.

In Michigan, the 1996 winter wolf survey confirmed the presence of 116 wolves in at least 16 packs across the Upper Peninsula of Michigan, a substantial increase from the recorded 80 wolves in 12 packs in 1995. An additional 22 wolves were counted on Isle Royale. There are no wolves in the Lower Peninsula of Michigan. The wolf increase in the Upper Peninsula from near extinction in the 1970's is due to both natural immigration and the production of pups.

Region 5

Flat-spired Three-tooth Land Snail *(Triodopsis platysayoides)* Construction was completed recently on a "snail fence" at Cooper's Rock State Forest in Monongalia County, West Virginia. The purpose of the fence is not to keep snails in, but to reroute human foot traffic in the area containing the largest known population of this threatened species. Foot traffic not only crushes the snails but also destroys the leaf litter in which they live. This project was funded by the FWS through the Ohio River Valley Ecosystem program and the West Virginia Nongame Wildlife Fund.

photo by Craig Stihler

Virginia Big-eared Bat *(Plecotus townsendii virginianus)* In June 1996, biologists with the West Virginia Department of Natural Resources took a census of the 11 known summer colonies of this endangered bat in West Virginia. The population appears to be stable in comparison to the 1995 level. One new summer colony was discovered in Grant County. It is a bachelor colony during the summer, but the cave may also be important as a breeding site. The number of bats using the cave more than doubled by early September, when the sex ratio of the bats was found to be nearly 1:1.

Spring Creek Bladderpod *(Lesquerella perforata)*

On December 23, 1996, the Fish and Wildlife Service listed the Spring Creek bladderpod, a winter annual in the mustard family (Brassicaceae), as an endangered species. This rare plant, which is restricted to a limited area within Tennessee's Central Basin, is vulnerable to extinction by the conversion of its habitat to other uses and by encroaching vegetation.

The Spring Creek bladderpod germinates in the fall, over-winters as a small rosette of leaves, and produces white to lavender flowers in the spring. Soon after the flowers wither, the fruits mature and the plant dies. Its seeds lie dormant until fall, when the cycle begins again.

This plant typically grows on flood plains. Historically, floods probably provided the periodic habitat disturbance needed to remove the perennial grasses and woody vegetation that quickly invade flood plains. The conversion of habitat to cropland may be compatible with the species' survival, depending on the farming techniques and timing used. In fact, annual crop production apparently is now the primary means by which essential bladderpod habitat is now maintained. However, conversion of sites to pastures or other uses that maintain a perennial cover crop are a significant threat.

Only four populations of the Spring Creek bladderpod are known to survive, all in Wilson County. Three former sites no longer support the species. Under the Endangered Species Act, recovery of this species will likely center on cooperative land management agreements with landowners in the area.

BOX SCORE

Listings and Recovery Plans as of January 31, 1997

GROUP	ENDANGERED U.S.	ENDANGERED FOREIGN	THREATENED U.S.	THREATENED FOREIGN	TOTAL LISTINGS	SPECIES W/ PLANS
MAMMALS	55	252	9	19	335	39
BIRDS	74	178	16	6	274	72
REPTILES	14	65	20	15	114	31
AMPHIBIANS	8	8	6	1	23	11
FISHES	67	11	40	0	118	74
SNAILS	15	1	7	0	23	18
CLAMS	56	2	6	0	64	43
CRUSTACEANS	14	0	3	0	17	6
INSECTS	24	4	9	0	37	20
ARACHNIDS	5	0	0	0	5	4
ANIMAL SUBTOTAL	332	521	116	41	1010	318
FLOWERING PLANTS	490	1	103	0	594	307
CONIFERS	2	0	0	2	4	1
FERNS AND OTHERS	26	0	2	0	28	18
PLANT SUBTOTAL	518	1	105	2	626	326
GRAND TOTAL	850	522	221	43	1,636*	644**

TOTAL U.S. ENDANGERED: 850 (332 animals, 518 plants)
TOTAL U.S. THREATENED: 221 (116 animals, 105 plants)
TOTAL U.S. LISTED: 1071 (444 animals***, 623 plants)

*Separate populations of a species listed both as Endangered and Threatened, are tallied twice. Those species are the argali, leopard, gray wolf, piping plover, roseate tern, chimpanzee, green sea turtle, saltwater/Nile crocodile, and olive ridley sea turtle. For the purposes of the Endangered Species Act, the term "species" can mean a species, subspecies, or distinct vertebrate population. Several entries also represent entire genera or even families.

**There are 446 approved recovery plans. Some recovery plans cover more than one species, and a few species have separate plans covering different parts of their ranges. Recovery plans are drawn up only for listed species that occur in the U.S.

***Four animals have dual status in the U.S.

ENDANGERED Species BULLETIN

U.S. Department of the Interior
Fish and Wildlife Service
Washington, D.C. 20240